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Notes on the biennial and perennial West American Species of Lappula

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In describing *Lappula arida* in this journal (28 : 44) I briefly called attention to the value of the fornices or appendages in the throat of the corolla as one means of distinguishing that species from *L. ciliata* (Dougl.) Greene. Indeed it was largely by the character of this appendage that it became clear that the handsome blue-flowered species common about Spokane, Wash., was identical with Douglas' original, an authentic specimen of which is in the Gray herbarium. Douglas' plant was in very young flower, so that it was only by comparing the throat appendages that it became certain that his plant was distinct from *L. arida*. In the course of this examination I was struck with the different forms of the throat appendages, which prove on further study to be very constant and therefore a helpful means of identifying specimens in flower only, as well as of distinguishing species. In describing *L. arida*, the fornices were said to be "not retuse." This is an error, as in all the biennial and perennial American species at least the appendage is notched. Briefly the appendage consists of an obcordate erect or connivent swelling, from the lower ventral face of which projects into the throat a protuberance. The size shape and surface of the appendage, the shape of the protuberance, and the relative dimensions of these parts furnish characters, which though difficult to describe, are found to be very reliable. In endeavoring to clear up the northwestern species, it became necessary to examine a large amount of material. The following results are based on a study of the material in

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the Gray herbarium, of that in the California Academy of Science, and of that in the herbaria of Mr. W. C. Cusick and Professor L. F. Henderson, together with my own. Besides the species here considered there are several more undoubtedly distinct species represented in the Gray herbarium, which owing to incomplete material it was not deemed wise to describe. It is very desirable in the future that collectors endeavor to secure both flowering and fruiting specimens of each species. The great bulk of the material in herbaria is either in flower or in fruit, so that it is often very difficult to determine which goes with which. Belated flowers in fruiting material are unsatisfactory, as they are frequently much smaller than is typical and therefore apt to be misleading.

So far as my experience goes in the field, the color of the flowers, contrary to what might be expected, is very constant. While white-flowered specimens are notoriously common in blue-flowered plants, the present genus seems to be exceptional in this respect.

Owing to the great confusion of material in herbaria, a full list of the specimens examined is given under each species.

Key to the Species

Biennials or perennials ; nutlets armed on the margins with free or united flat subulate glochidiate prickles.

I. Back of nutlets unarmed or with short glochidiate prickles ; marginal prickles free to the base or nearly so.
Corolla appendages smooth or merely papillate.
Appendages broader than long : protuberance short, broad : flowers blue.
Flowers small, 4–6 mm. broad. 1. *L. floribunda.*
Flowers larger, 8–10 mm. broad. 2. *L. diffusa.*
Appendages as long as broad : the oblong protuberance scarcely projecting : flowers white.
Foliage rather softly pubescent. 3. *L. Hendersoni.*
Foliage harshly papillose-scabrous. 4. *L. trachyphylla.*
Corolla appendages pubescent.
Flowers small, less than 5 mm. broad ; appendage about as broad as long, short-pilose, the protuberance very small. 5. *L. pinetorum.*
Flowers larger, 5–12 mm. broad.
Appendage short-pilose.
Flowers white : pubescence rather harsh, mostly appressed except on the lower part of the stem and the leaf-margins. 6. *L. arida.*
Flowers blue : pubescence soft, not appressed. 7. *L. saxatilis.*
Flowers blue : pubescence smooth, very closely appressed except a few bristles on the lower petioles. 8. *L. Cusickii.*

Appendage hirsute, the hairs as long or longer : flowers bluish (or sometimes white ?). 9. *L. caerulescens.*

II. Back of nutlets unarmed or with short glochidiate prickles ; lateral prickles united for about half their length.

Flowers greenish : corolla-lobes broadest at base ; appendage smooth, much broader than long, lunate, the protuberance forming a short blunt tooth. 10. *L. hispida.*

Flowers blue : corolla-lobes suborbicular ; appendages short-pilose ; protuberance short.

Back of nutlets with glochidiate bristles.

Flowers blue : pubescence fine, appressed. 11. *L. ciliata.*

Flowers blue : leaves bristly, green. 12. *L. setosa.*

Flowers white : leaves bristly, ashy-gray. 13. *L. cinerea.*

Back of nutlets without glochidiate bristles.

Back of nutlets coarsely granulate-scabrous, with central ridge faint or none. 14. *L. ursina.*

Back of nutlets nearly smooth, with a prominent central ridge. 15. *L. scaberrima.*

III. Back of nutlets with glochidiate prickles about as long as the marginal ones.

Corolla white, rotate, the tube not exceeding the calyx ; appendage broader than long, short pilose. 16. *L. Californica.*

Corolla blue or pink, short-salverform, the tube longer than the calyx.

Corolla 10–15 mm. broad : appendages very large, one third as long as the corolla lobes ; protuberance equally long : pubescence velvety. 17. *L. velutina.*

Corolla 6–8 mm. broad : appendages small, one sixth as long as the corolla-lobes, the protuberance very small : pubescence not velvety. 18. *L. nervosa.*

1. LAPPULA FLORIBUNDA Greene, Pittonia, **2** : 182. 1891

Echinospermum floribundum Lehm. Pugillus, **2** : 24. 1830.

Specimens of this species in fruit are very easily distinguished from fruiting specimens of the following, but flowering specimens are sometimes distinguishable only with difficulty. The only differences which seem to separate the two species in flower are the smaller corollas and denser racemes of *L. floribunda.* According to Cusick, *L. floribunda* is always biennial in duration, *L. diffusa* perennial. So far as fruiting material goes there seem to be but two species, but Dr. Rydberg has segregated a third supposed species, *L. leptophylla* Rydb. (Fl. Mont. 329. 1900), of which I have seen no specimen. It is said to be distinguished from *L. floribunda* by having smaller flowers and thinner leaves. It is very desirable that collectors take careful note in the field as to whether variations in the size of the corolla are correlated with other differences. *L. floribunda* as at present received shows some variation as regards the size of the flowers and also in pubescence.

The following specimens are referred to this species.

WASHINGTON: Yakima Region, July 1883, *Brandegee, 986.*

OREGON: Without locality, 1881, *Cusick, 118.*

CALIFORNIA: Lake Tahoe, *Lemmon;* without locality, 1874, *Lemmon, 734;* Susanville, Lassen county, 2 July 1892, *Brandegee;* Lake City Pass, July, 1892, *Mrs. R. M. Austin.*

IDAHO: Hailey, 22 July 1895, *Henderson, 3195;* Challis Divide, 3 August 1895, *Henderson, 3619.*

NEVADA: Ruby Valley, August 1868, *Watson, 860.*

UTAH: American Fork Cañon, 16 July 1895, *M. E. Jones;* Provo, 8 July 1894, *M. E. Jones, 5594;* Wasatch Mts., July 1869, *Watson, 860.*

ARIZONA: Casnino, August 1883, *Rusby, 746;* Base of San Francisco Mt., September 1884, *J. G. Lemmon & wife.*

COLORADO: Near Dix P. O., 10 July 1898, *Baker, Earle & Tracy, 471;* Golden City, 8 June 1870, *Greene, 306;* Headwaters of Clear Creek, 1861, *Parry, 290;* Estes Park, 8 June 1884, *J. Ball;* Pagosa Springs, July 1899, *Baker, 551;* Canon City, June 1877, *Brandegee;* Clear Creek Cañon, 10 June 1870, *Greene;* Without locality, *Hall & Harbour, 437.*

WYOMING: Yellowstone Lake, 24 August 1899, *A. & E. Nelson, 6647;* Sybille Creek, 8 July 1894, *A. Nelson, 348;* between Sheridan and Buffalo, 15 June–15 July 1900, *Tweedy, 3579.*

MONTANA: Without locality, 3 July 1883, *Scribner, 171;* Glen Creek, 29 July 1899, *A. & E. Nelson, 5561.*

ASSINIBOIA: Crane Lake, 9 June 1894, *Macoun.*

SASKATCHEWAN: Without locality, 1858, *Bourgeau.*

2. LAPPULA DIFFUSA Greene, Pittonia, **2**: 182. 1891

Echinospermum diffusum Lehm. Pugillus, **2**: 23. 1830.

I have followed Dr. Gray in his interpretation of this species and as he compared his materal with the type it is doubtless correct. According to this view Lehmann's characterization of the corolla as white is an error. It is barely possible however that Lehmann's original is a different plant from the one here considered, as there are at least three white-flowered species in the Columbia Basin, whence the type of *E. diffusum* came, viz., *L. Hendersoni*, *L. arida* and *L. Californica*. It is impossible to reconcile either of the first two with the original description of *E. diffusum*, but it is possible that it may prove to be identical with *L. Californica*.

The following specimens have been examined.

BRITISH COLUMBIA: Above Lake Louise, 27 July 1895, *Canby;* Kicking Horse Lake, 11 August 1890, *Macoun;* Lake Louise, 9 August 1898, *J. R. Anderson;* near Banff, 9 July 1891, *Macoun, 676.*

WASHINGTON: Wenatchee Mts., 3 June 1900, *Whited, 1258;* Klickitat River, 27 June 1899, *Flett, 1011;* without locality *Vasey, 420;* near Ellensburg, 21 May 1897, *Piper, 2669;* Blue Mts., 7 August 1897, *Horner, 341;* 11 June 1897, *121.*

OREGON: Near Snake River, 25 May 1898, *Cusick, 1887;* Stein's Mts., 30 June 1898, *Cusick;* without locality, 1879, *Cusick, 614;* Pine Creek, July 1893, *Mrs. R. M. Austin, 121;* Quartz Valley, Lake county, *Mrs. R. M. Austin;* Mt. Ashland, 9 July 1886, *Henderson;* Wallowa River below the Lake, 10 August 1899, *Cusick, 2323;* Powder River Mts., August 1896, *Piper, 2494.*

CALIFORNIA: Cottonwood Creek, White Mts., 13 July 1891, *Coville and Funston, 1811;* Siskiyou Mts., June 1884, *Howell, 219;* Sisson, Siskiyou county, *H. E. Brown, 327;* near Mineral Springs, Tulare county, 4 August 1891, *Coville & Funston, 1484;* Janesville, Lassen county, 29 June 1892, *Brandegee.*

IDAHO: Banks of Kootenai River, 1861, *Lyall.*

UTAH: Thistle, 29 June 1894, *M. E. Jones, 5529;* without locality, 1891, *Mrs. W. C. Dodd.*

MONTANA: Spanish Basin, Gallatin county, 26 June 1897, *Rydberg & Bessey, 4895;* Bridger Mts., 12 June 1897, *Rydberg & Bessey, 4896.*

Echinospermum subdecumbens Parry (Proc. Davenport Acad. **1**: 48) is probably a synonym of *L. diffusa;* at least an authentic specimen in young flower in the Gray Herbarium seems to be referable here. The specimen is from central Utah.

3. **Lappula Hendersoni** sp. nov.

Perennial, erect, 60–80 cm. high, rather sparsely and softly pubescent with appressed hairs, leafy to the top: leaves green, thin, the radical spatulate-lanceolate; cauline lanceolate, attenuate, sessile, gradually reduced upward, the upper ones ciliate with long hairs, the middle ones 5–10 cm. long: flowering branches racemosely arranged: cymes 5–10-flowered: calyx-lobes linear-lanceolate, obtusish: corolla white, 10–12 mm. broad; appendage as broad as long, merely papillate, the protuberance oblong, short, scarcely protruding into the throat: fruit (nearly mature) about 6 mm. long, on longer recurved pedicels; back of nutlets flat, muriculate, bearing a few scattered short glochidiate prickles; marginal prickles flat, of two lengths, free to the base or nearly so, the longer ones equalling or exceeding the diameter of the back; inner face smooth, the oblong scar central.

Clemens Mountain, Yakima county, Washington, 14 June 1892, *L. F. Henderson* (type). Specimen in herbarium Washington State College.

The following specimens are also confidently referred here:

WASHINGTON: Moist shady rocks, Klickitat county, June 1881, *Suksdorf;* Upper Yakima, 1860, *Lyall.*

OREGON: Cliffs along the Columbia River, August 1880, *T. J. Howell;* Deschutes, 1879, *Howell;* "Hood River, Celilo, etc.," June 1886, *Henderson, 88.*

A doubtful specimen is Howell's no. 335, Rooster Rock, Ore., with blue flowers.

The Suksdorf and Henderson specimens have mature fruit. In these the back of the nutlet is more or less convex, with a faint central ridge, muriculate, bearing 10–12 short glochidiate bristles; ventral surface sparsely muriculate, the oblong scar central.

4. **Lappula trachyphylla** sp. nov.

Probably perennial, apparently about 60 cm. high: stem and branches hispid: upper leaves sessile, lanceolate, attenuate-acuminate, 4–5 cm. long, harshly scabrous on both faces with hispid, papillate-based hairs; upper leaves passing gradually into the bracts of the inflorescence: branches 10–15 cm. long, loosely 10–15-flowered: calyx-lobes attenuate, hispid, 4–5 mm. long: corolla white, the tube not exceeding the calyx, the limb 10–12 mm. broad; appendages as broad as long, merely papillose, the protuberances small: pedicels decidedly longer than the fruit: nutlets 5 mm. long, the marginal prickles free to the base; back plane, muriculate, bearing several short glochidiate prickles; ventral side muriculate, the scar central.

A single fragmentary specimen in the Gray herbarium, collected by Winslow J. Howard in Montana. Associated with it are two inflorescences of *L. diffusa*.

5. LAPPULA PINETORUM Greene, Pittonia, **2**: 182. 1891

Echinospermum pinetorum Greene; Gray, Proc. Am. Acad. **17**: 224. 1872.

This species appears from the specimens to be an annual. The following specimens are in the Gray herbarium:

NEW MEX.: Pinos Altos Mts., July and September 1880, *Greene*.

ARIZONA: Santa Rita Mts., 13 July 1881, *Pringle, 349;* North Arizona, 1884, *Lemmon, 3211*.

6. LAPPULA ARIDA Piper, Bull. Torrey Club, **28**: 44. 1901

In addition to the specimens cited in the original description the following are referable here:

WASHINGTON: Without locality, 1889, *G. R. Vasey, 419*.

OREGON: Camp Harney, 26 May 1885, *Howell;* Camp Harney, 1875, *Captain Bendire;* Drew's Valley, Lake county, *Mrs. R. M. Austin 282*. This specimen is referred to *L. arida* with considerable hesitation.

The two following species are very near allies, and further material may compel their reduction. In all three the fornices of the corolla are practically identical.

7. **Lappula saxatilis** sp. nov.

Perennial, about 30 cm. high, rather slender, cinereous throughout with a fine short rather soft pubescence intermixed with some longer hairs, especially on the petioles of the lower leaves and margins of the upper ones: radical and lower cauline leaves oblanceolate, acute, the petioles as long or nearly as long as the blades; upper cauline lance-linear, sessile by broad bases; bracts of the inflorescence leaf-like; branches 6–10-flowered; calyx hispid, the lobes 2–3 mm. long: corolla blue, rotate, about 7 mm. broad; appendages pubescent, broader than long, exceeded by the obovate-oblong protuberance: fruit small, 3–4 mm. long; marginal prickles 4–5 on each side, subulate, glochidiate, slightly united at base; dorsal surface muriculate, bearing a few short glochidiate prickles; ventral surface smooth; scar central.

Rocky sides of cañons, Klickitat River, Wash., 12 June 1885, *W. N. Suksdorf, 592*. Type specimen in Gray herbarium.

Very close to *L. arida*, differing in its smaller blue flowers, softer pubescence, and the smaller fruit without granulations on the ventral side.

8. **Lappula Cusickii** sp. nov.

Perennial, erect or ascending, 15–30 cm. high, the caudex thickly clothed with old leaf bases, the whole plant pale bluish-green with a very closely appressed fine pubescence, except on the petioles where it is hirsute-ciliate: radical leaves lanceolate, acute, 4–8 cm. long, the petioles equaling the blades; cauline leaves linear-lanceolate, acute, all but the lower sessile by broad bases, 2–5 cm. long: inflorescence corymbose, the false racemes 6–8-flowered: calyx-lobes linear, acute, 2 mm. long: corolla blue, 5–6 mm. broad; appendages short pilose, about as long as broad, the protuberance oblong, as long or longer; immature fruit 5 mm. long, the back flat, muriculate, and bearing about 10 short glochidiate bristles; marginal prickles flat, separate and rather distant, all glochidiate, shorter than the diameter of the nutlet.

Logan Mountains, eastern Oregon, 6500 feet altitude, in the shelter of juniper, 1 July 1901, *W. C. Cusick, 2623.*

This species is related to *L. arida*, differing in its smaller blue flowers and the separate marginal prickles of the nutlet.

9. LAPPULA CAERULESCENS Rydberg, Flora Montana, 328. 1900

This species is readily distinguished from any other described species by the long hairs of the corolla-appendages. At least one other undescribed species represented in the Gray herbarium by too scanty material, has a very similar corolla-appendage, so that this character alone can not be entirely relied upon.

The species as here interpreted shows considerable variation as regards pubescence, and in some specimens the flowers are apparently white.

MONTANA: Bridger Mts., 18 July 1897, *Rydberg & Bessey, 4899.*

WYOMING: Mammoth Hot Springs, 30 June 1899, *A. & E. Nelson, 5602.*

UTAH: Salt Lake City, May 1891, *Eastwood;* Salt Lake City, 30 April 1898, *W. Travers;* Salt Lake City, May 1889, *Sarah K. White;* Wasatch Mts., May 1869, *Watson, 860;* Pine Valley, June 1874, *Parry, 172.* In this plant the pubescence is hirsute, and it was included by Dr. Gray under *Echinospermum* *ursinum.* The fornix is exactly like that of the present species, but it is possible that fruiting material may show additional characters.

NEVADA: Battle Mts., June 1868, *Watson, 860;* Humboldt Mts., 27 May 18—, *Beckwith.*

In the original description of this species the fruit was not described. The following are its characters as it occurs on the Nelson specimen above cited:

Nutlets 3 mm. long; marginal prickles of two lengths, free to the base or nearly so, all glochidiate; back plane or with a more or less evident central ridge densely finely muriculate and bearing about ten short glochidiate prickles; ventral surface finely rugose.

10. LAPPULA HISPIDA Greene, Pittonia, **2**: 182. 1891

Echinospermum diffusum var. *hispidum* Gray, Proc. Am. Acad. **17**: 225. 1882.

E. hispidum Gray, Proc. Am. Acad. **20**: 259. 1884.

This species differs from any other which I have examined in having the corolla-lobes broadest at base. The species proper has been collected only by Cusick in eastern Oregon as follows: 1880, rocky hillsides of Pine Creek near the mouth, *855;* 31 May 1898, hillsides near Snake River, *1906;* 15 June 1898, Burnt River, *1906;* without locality, 1885.

The Wilcox specimen referred here by Dr. Gray in the original description belongs to *L. cinerea* as above. The Watson specimen referred here with some doubt in the Synoptical Flora (**2**: 422) is an undescribed species.

11. LAPPULA CILIATA Greene, Pittonia, **2**: 182. 1891.

Cynoglossum ciliatum Dougl.; Lehm. Pugillus, **2**: 24. 1830.

Echinospermum ciliatum Gray, Proc. Am. Acad. **17**: 225. 1882.

The original specimens of this species were collected by Douglas according to the note in Hooker's herbarium, "On the gravelly banks of mountain streams near the head springs of the Columbia"; according to the note in Bentham's herbarium, "Kettle Falls and Spokan River, 1826."

The plant is quite common on the gravelly bluffs of Latah Creek and of the Spokane River within the environs of Spokane, Wash. The following specimens agree exactly with the Douglas specimen in the Gray herbarium.

Spokane, 1 June 1891, *Henderson;* Spokane, 16 May and 2 July 1896, *Piper, 2292;* Hangman Creek, 18 May 1893, *Sandberg & Leiberg, 36.*

The following is a description of the fruit:

Nutlets 5 mm. long; marginal prickles united for about half their length into a wing, all the prickles glochidiate; back plane or usually with a faint central ridge, roughly muriculate and bearing eight or ten short glochidiate prickles; ventral surface smooth, the scar central.

12. **Lappula setosa** sp. nov.

Perennial, 30–60 cm. high, bristly hirsute throughout, without any finer pubescence: radical leaves linear-oblanceolate, obtuse or acute, 6–10 cm. long including the petioles; cauline sessile or nearly so, linear or lance-linear, gradually reduced upwards; calyx-lobe oblong-linear, obtuse, hispid, 3–4 mm. long: corolla bright blue, 12–15 mm. broad, the tube not exceeding the calyx; appendage semicircular, short pilose, the protuberance small: fruit 5 mm. long, the marginal prickles united for one half their length into a wing: dorsal surface nearly plane, granulate scabrous, bearing a few very short glochidiate bristles; ventral surface granulate, the narrowly triangular scar central.

OREGON: Waldo, June 1884, in flower, *Howell, 218.*

CALIFORNIA: Siskiyou Mountains, 17 June 1884, in flower, *Howell;* Snow Mountain, 23 June 1892, in flower, *Brandegee;* Sierra Valley, July 1883 (type), in fruit, *Lemmon.* Specimen in herbarium California Academy of Science.

A well-marked species, easily recognized by its large blue flowers and bristly pubescence.

13. **Lappula cinerea** sp. nov.

Perennial, erect, 40–60 cm. high, cinereous throughout with appressed pubescence, some coarser hispid hairs intermixed, the larger of which are papillate at base: basal leaves linear or linear-lanceolate, obtusish, 6–10 mm. long; cauline similar, rather few, reduced upwards: inflorescence in fruit loose, the branches 5–20 cm. long: calyx-lobes linear-lanceolate, acute: corolla white, the tube 2 mm. long, the obovate-orbicular lobes 3 mm. long; appendages short-pilose, the crest semicircular in form, retuse at apex, the protuberance on the inner side hemispherical, and separated by a smooth depression from the pilose crest: nutlets 3–4 mm. long, the marginal prickles united at base for about half their length, all glochidiate; dorsal surface with a faint central ridge, muriculate, and bearing 6–12 glochidiate bristles half as long as the marginal ones; inner face smooth, the oblong scar central.

Salmon River bluffs, Idaho, altitude 2500 feet, 2 July 1895, *L. F. Henderson, 3006.* Type in the U. S. National herbarium, no. 231836.

I would also refer here two specimens from Boise, Idaho; one collected by A. Isabel Mulford, July and August, 1892, which in the Gray herbarium specimen is mixed with *L. floribunda;* the other collected June 1881, by *Dr. T. E. Wilcox* and referred by Dr. Gray to *L. hispida.* The fruit of the Wilcox specimen is rather larger than that of the type, being 5 mm. long.

14. LAPPULA URSINA Greene, Pittonia, **2**: 182. 1891

Echinospermum ursinum Greene; Gray, Proc. Am. Acad. **17**: 224. 1882.

No other material has been seen of this species except that which was before Dr. Gray. Fendler 633 from New Mexico referred here by Dr. Gray is very probably a distinct species undescribed. Parry's 172 collected in South Utah in 1874 is a form of *L. caerulescens.*

15. **Lappula scaberrima** sp. nov.

Perennial, erect, 25–50 cm. high: stems softly hirsute below, hispid above: leaves harshly hispid on both faces, the closely appressed short hairs with papillose bases; basal leaves spatulate-oblanceolate, obtuse, petioled; cauline oblong-lanceolate, acutish: branches of the inflorescence with 15–25 rather densely crowded flowers: calyx hispid, the ovate-oblong lobe obtuse: corolla blue, the tube barely exceeding the calyx, the limb 5 mm. broad; appendages broader than long, papillose, the protuberance small: fruit 5 mm. long on recurved pedicels about as long: nutlets with the marginal prickles united into a wing, all glochidiate; back smooth with a prominent heel; ventral surface smooth, the triangular scar central.

Cripple Creek, Colo., 3 August 1897, *Eastwood,* type, in herbarium Cal. Academy of Science.

Above Idaho Springs, Colo., August and September 1874, *Engelmann.*

A species probably nearest related to *L. floribunda*. The united marginal prickles and scabrous foliage easily distinguish it.

16. **Lappula Californica**

Echinospermum Californicum Gray, Proc. Am. Acad. **17**: 225. 1882 (in part).

Perennial, erect, leafy, green, 30–80 cm. high: pubescence fine and sparse, soft below, almost hispidulous above in fruiting specimens: lower leaves oblong-lanceolate, obtuse or acute, the petioles nearly as long as the blades; middle leaves oblong-lanceolate, sessile by broad bases; upper leaves lanceolate or even ovate, sessile or partly clasping, mostly acute: panicle in fruit open, the branches about 6-flowered: corolla white, its tube barely exceeding the calyx; appendage broader than long, puberulent, the protuberance small: nutlets granulate-muriculate on both faces; dorsal face and margin bearing 20–30 glochidiate subulate separate prickles, as long as the diameter of the nutlets, with shorter ones intermixed; scar central, large, ovate-triangular.

The following specimens are referred here.

California: Mt. Shasta, 6000 ft. alt., 23 August 1881, *Pringle* (type); Mt. Shasta, 5000 ft. alt., 1862, *Brewer, 1416;* Sisson, July 1892, *Brandegee;* near Webber Lake, 1875, *Lemmon, 1204;* Lake Tahoe, *Lemmon, 205.* Both the Lemmon specimens have the prickles of the fruit purple, and the nutlets apparently smooth on the ventral side; Prattville, Plumas county, 2 April 1892, *Brandegee;* Prattville, Plumas county, June 1878, *R. M. Austin.*

Oregon: Near "Three Sisters," 5 August 1881, *Henderson;* Black Butte, Crook county, 19 July 1901, *Cusick, 2680.*

17. **Lappula velutina** sp. nov.

Perennial (or perhaps biennial), tall and stout, 30–90 cm. high, clothed throughout with a dense velvety pubescence: lower cauline and radical leaves spatulate-oblanceolate, acutish, 8–10 cm. long; cauline numerous, mostly sessile by broad bases, oblong-linear or lanceolate, acute or obtuse, gradually reduced upwards, 2–8 cm. long: inflorescence open, the branches 5–10-flowered: calyx densely pubescent, the oblong lobes obtuse: corolla blue or sometimes pink, its tube 5 mm. long, much exceeding the calyx, the limb 10–12 mm. broad; appendages very large and conspicuous, one third as long as the corolla lobes, the deeply cordate crest short-pilose, equalled in length by the oblong protuberance:

fruit 6–8 mm. long, shining, covered all over with subequal glochidiate separate prickles; ventral surface smooth, the scar central.

This is apparently the commonest California species. It is readily distinguished from all others at a glance by its velvety pubescence, its large blue salverform corollas, and the very prominent corolla appendages.

The following specimens have been examined, all from California: General Grant Grove, 20 July 1892 (type in herbarium California Academy of Science), *Brandegee;* General Grant Park, 1–13 July 1899, *Eastwood;* Lake Tahoe, June 1900, *Miss King;* Lake Tahoe, July 1895, *Abraham;* Lake Tahoe, *Lemmon*, Tulare county, June 1896, *Purpus, 1777;* Humboldt county, 1885, *C. C. Marshall;* Amador county, June 1886, *Mrs. Wiley;* Armstrong Station, 13 June 1895, *G. Hansen, 1141;* Summit, Eldorado county, July 1899, *Blaisdell, 96.*

The Cusick specimen was distributed as a new species but on further study it is thought best to refer it here.

It has been a matter of some difficulty to decide upon a type for this species, inasmuch as Dr. Gray confused three very different plants under one name and did not definitely indicate a type either in the published description or in his herbarium. The difficulty is easily understood from his original description which follows:

> "3. Comparatively large-flowered, perennial, with tube of the corolla surpassing the calyx and about the length of the lobes: nutlets of the globose fruit equally armed over the whole surface and margins with long and slender but flattish minutely glochidiate prickles.
>
> "E. CALIFORNICUM. *E. diffusum* Gray, Syn. Fl. (excluding small-flowered specimens which belong to the true *E. diffusum*, and *excl. syn.* Kellog?) not of Lehm. Sierra Nevada, California, from Mount Shasta southward. This was taken for Lehmann's *E. diffusum*, because of his description of the corolla ('Corolla alba? magna, tubus calyce paullo longior sensim ampliatus'); and Californian specimens of the real *E. diffusum* were mixed with it. The original specimens of the latter do not have the exserted tube of the corolla which marks the present species when in blossom, as does the fruit at maturity. It is the *E. nervosum* of Kellog; but neither the leaves nor the sepals are perceptibly nervose (the former not '3–5-nerved' nor the latter '3-nerved'), so that the name would be a false one."

It is perfectly clear that the flower characters of the above description were taken from the specimens *L. velutina* and *L. nervosa* as they alone have salverform corollas. The fruiting characters were drawn from the Brewer and Pringle specimens, perhaps also from the Lemmon specimens. As the flower characters are the most important in separating *L. Californica* and *L. velutina*, and presumably of *L. nervosa* the fruit of which is unknown, one might justly lay stress on this element of the description. This course would either reduce *L. Californica* to a synonym of *L. nervosa*, or compel its use for the other salverform-flowered segregate, *L. velutina*.

The type range as given in the original description, however, points clearly to the Pringle and Brewer specimens as the type as only these Mt. Shasta species were before Dr. Gray. On the whole it has seemed to us best to retain the name *L. Californica* for this Mt. Shasta plant. We therefore designate the Pringle specimen as the type because it is in better condition than the Brewer specimen.

South Sierras, *Bolander, 2784*; without locality, *Bridges, 317*; without locality, *Grav, 1872*.

18. LAPPULA NERVOSA Greene, Pittonia, **2**: 182. 1891.

Echinospermum nervosum Kellogg, Proc. Calif. Acad. **2**: 146. 1862.

Perennial, erect, leafy, 20–40 cm. high, finely appressed pubescent throughout but green: leaves 3–8 cm. long, oblong-linear or somewhat oblanceolate, acute or obtuse, the upper sessile by broad bases, the lower narrowed into margined petioles: panicle rather narrow: calyx small, 2 mm. long: corolla blue, its tube 4–5 mm. long, much exceeding the calyx, the limb about 6 mm. in diameter: appendage quadrate, minutely pilose, the protuberance very small: fruit not seen.

An apparently authentic fragment of the type is in the Gray herbarium, labelled "Acad. Calif. sent by E. L. Greene." This is matched by several specimens in the herbarium of the California Academy of Sciences as below cited. The plant is clearly different from *L. Californica* and from *L. velutina*, and should easily be recognized by its small salverform corollas with small appendages.

CALIFORNIA: Summit, Placer county, 8–16 June 1898, *Alice Eastwood*; Summit, Placer county, July 1876, *Henry Edwards*; Summit, Placer county, 5 July 1886, *Sonne, 69*; Yosemite Valley, May and June 1900, *Bioletti*; without locality, 1872, *Bolander*.

19. **Lappula Cottoni** sp. nov.

Perennial, erect, 40–60 cm. high, pale green throughout with appressed rather harsh white hairs, equally leafy to the top: leaves rather numerous, the radical spatulate, lanceolate, acute, petioled, 10–15 cm. long, the cauline linear or linear-lanceolate, acute, sessile or nearly so by broad bases, 2–5 cm. long: flowering branches racemosely arranged: lower bracts leafy, the upper much reduced: calyx-lobes linear, obtuse or acutish, 2–3 mm. long: corolla yellowish, 6–7 mm. broad, the lobes oval, broadest above the base: appendages broader than long, short pilose, the hemispherical protuberance nearly as long.

North slope of Rattlesnake Mountains, Yakima county, Washington, 11 May 1901, *J. S. Cotton, 360.* Type in herbarium Washington State College.

A species with the aspect of *L. Californica* but with smaller yellowish flowers, very different corolla appendages and more leafy inflorescence.